**Justification for Other than Full and Open Competition (JOFOC)**
**Total and Spectral Irradiance Sensor (TSIS) Procurement**

1. **This document is a justification for other than full and open competition prepared by NASA's Goddard Space Flight Center (NASA's GSFC):**

The NASA's GSFC proposes to enter into a contract with the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado. This document justifies the determination for using other than full and open competition.

2. **The nature and/or description of the action being approved:**

This justification provides the rationale for contracting by other than full and open competition for NASA's acquisition of a Total and Spectral Irradiance Sensor (TSIS) from the LASP at the University of Colorado, Boulder, Colorado. The TSIS suite of instruments was originally part of a competitive acquisition by the Integrated Program Office (IPO) of the National Polar orbiting Operational Environmental Satellite System (NPOESS). IPO received two competitive proposals, and LASP was the TSIS instrument provider on both of the proposals. The NPOESS contract was awarded to a team led by Northrop Grumman Space Technologies (NGST), and including LASP. Since 2002, LASP has been under contract to NGST to do the preliminary design and definition work for TSIS and has performed under that contract. In 2006, the IPO de-manifested TSIS from the NPOESS program and the C2 satellite when the scope of the program was reduced due to cost overruns not associated with TSIS. Subsequently, National Oceanic and Atmospheric Administration (NOAA) has been authorized and will be funded in Fiscal Year 2009 to re-manifest TSIS on the NPOESS C1 satellite with NASA responsible for procurement of TSIS.

3. **Description of the supplies or services required, including an estimated value:**

NOAA has operational climate responsibility to fill the solar irradiance data gap between the Solar Radiation and Climate Experiment (SORCE), launched in 2003, the Glory mission to be launched in 2009, and NPOESS C2, planned for launch in 2016. To fulfill this responsibility, NOAA intends to deploy TSIS on the NPOESS C1 mission to be launched in early 2013. TSIS consists of two instruments: the Total Irradiance Monitor (TIM) and the Spectral Irradiance Monitor (SIM), and also includes an integral pointing system. TSIS on the NPOESS C1 mission will continue the key climate measurement of Total Solar Irradiance (TSI) and Spectral Solar Irradiance (SSI), which are currently being measured by TIM and SIM on the SORCE mission and by TIM on the Glory mission. NOAA has transferred responsibility and will transfer funding to NASA to manage the development and delivery of TSIS to the Mission System Contractor for the NPOESS C1 Mission.

The continued measurement of the TSI and SSI, at current state-of-the-art accuracy, without temporal gaps in the dataset, comprises the solar irradiance requirement for TSIS

on the NPOESS C1 mission. It is essential that there be no temporal gaps in the data, as any measured shift in the atmospheric temperature must be correlated with the solar irradiance and sufficient overlap is needed so that improvements in calibration accuracy may be transferred to the earlier record of measurements.

The estimated cost of this procurement is [text deleted].

**4. Statutory authority permitting other than full and open competition:**

The statutory authority for this JOFOC is 10 U.S.C. 2304(c)(1), only one responsible source.

**5. A demonstration that the proposed contractor's unique qualifications or the nature of the acquisition requires use of the authority cited:**

The fundamental requirement for TSIS on NPOESS C1 is to make precise and accurate measurements of TSI and SSI and connect them to previous TSI and SSI measurements to form a long-term climate record. The TSI measurements shall have an absolute accuracy of 0.01% (100 parts per million (ppm)) based on the International System of units and shall have a relative accuracy of 0.001% per year. The SIM requirement is to make SSI measurements with a combined standard uncertainty of less than 0.1% and a long-term relative accuracy of 0.03% (300 ppm).

The high level measurement requirements described above flow into specific instrument requirements. The NPOESS C1 TSIS must be sensitive over the entire solar spectral range up to extreme wavelengths that contribute less than the 100 ppm requirement for absolute and 300 ppm for spectral irradiance measurements. The NPOESS C1 TSIS instruments must be absolute radiometers as opposed to relative radiometers. This means that a system to reduce 1/f noise must be included. An absolute radiometer has an internal absolute calibration source capable of fully establishing the measurement scale. The radiometric detectors must be absorbing to a level of reflectance less than 0.02%. The TSIS supplier is required to deliver a Level 1 science analysis system together with the instrument. TSIS measurements must be traceable to the National Institute of Standards and Technology (NIST) and other international irradiance standards, as well as to the SORCE and Glory TIM and the SORCE SIM instruments. Since the NPOESS C1 spacecraft will be nadir pointing, similar to the Glory spacecraft, and the TSIS must point to the sun, it is required that the TSIS include a solar pointing platform. All requirements must be met by the integrated instruments/pointing platform combination.

LASP designed, developed, and now operates the TIM and SIM for the SORCE mission, and designed and developed the TIM for the Glory mission. LASP has built TIM and SIM witness units in parallel to the SORCE mission TIM and SIM flight units. These witness units are identical to the SORCE flight units using the same lot components. They allow precise monitoring of performance on the ground to compare with the flight instruments to observe any possible change in performance. It also provides the ground-based standard for measurement comparisons for follow-on instruments, so that the

standard may be compared from the current SORCE instruments to future instruments. The traveling TIM instrument is a unique capability built and maintained at LASP that was built in parallel with the flight and witness TIM instruments. The traveling TIM instrument has the same design and key detector components that allow it to operate in a round-robin fashion for comparison to world standards of irradiance. This unique instrument is part of the on-going standardization process that allows the LASP flight TIM to be the absolute standard for TSI measurements.

The witness TIM and the traveling TIM, together with the ground calibration facility, are necessary to meet TSIS requirement for NPOESS C1 mission for continuity with the SORCE and Glory TIMs, as well as meeting the requirement for traceability to the irradiance standards maintained at NIST and other international standards organizations. These instruments are also necessary during the testing phase for the TSIS.

The ground software for TIM and SIM data processing was designed and built by LASP and has been fully qualified by the NASA IV&V processes. It is unique to the LASP TIM and SIM operation and their phase-sensitive detection algorithms. The Algorithm Theoretical Basis Document has been fully reviewed by NASA Earth science groups and fulfills the TSIS requirement for an in-place system that produces Level 1 science products.

LASP has developed and qualified a two-axis pointing platform for the Glory TIM and had designed a two-axis pointing system for the NPOESS TSIS instrument suite before it was de-manifested. The mechanism's design and requirements for the Glory pointing platform gave LASP the relevant pointing platform experience for the NPOESS C1 mission.

Because LASP has an existing TSIS design adequate to meet NPOESS CI mission requirements, and the experienced staff to build, integrate and test the TSIS system, it is the only organization that can meet the NPOESS C1 mission schedule. The TIM and SIM instruments are at the NASA Civil Space Technology Readiness Level (TRL) of 9. Level 9 is the highest level on the TRL scale. The TRL 9 is defined as an "actual system flight proven through successful mission operation." NASA engineering and management practice allows for instruments at TRL 9 to be placed in the lowest category of risk with regards to cost, schedule, and technical performance. Typically, at least one year in schedule acceleration can be gained by the re-flight of an existing instrument over an existing design. For a new design, mass and power margins of 30 percent need to be held before the Preliminary Design Review. With a TRL 9 instrument, a 10 percent power margin is adequate and puts important technical metrics at considerably less risk. The maturity of the LASP TSIS will allow for the integration into the spacecraft at extremely low risk. There is no other potential provider of a TSIS system that can meet the technical requirements for the program and who is capable of proposing a TIM or SIM instrument currently at TRL 9.

Through performance of the SORCE and Glory missions and work completed for the IPO on NPOESS, LASP has acquired the specialized expertise that is critical to reaching the

successful completion of the TIM and SIM instruments integrated into the TSIS for NPOESS C1. This technical expertise resides in the knowledge of the unique devices, computer software, and instrument formulation that were designed, developed, and implemented by LASP personnel. An intricate understanding of the relevant hardware and software is crucial to meeting the performance of the TSIS system development and performance. Only LASP meets the Government's primary requirement for continuity. Were GSFC to hold a competitive acquisition for this effort, the duplication of necessary efforts and corresponding delays inherent in having a different contractor develop a TSIS system that would satisfy the Government's requirement would introduce unacceptable risks to the timely execution of the NPOESS C1 mission, both in cost and schedule. It would require a contractor to develop hardware, software, and test capabilities consistent with the SORCE TIM and SIM instruments and with the Glory TIM instrument before that contractor could go on to build a TSIS instrument. In addition to the hardware, software, and test facilities, another contractor would have to develop personnel expertise and experience along with engineering, management, and quality assurance plans, processes, and procedures associated with the design, manufacture, integration, test, and calibration of TIM and SIM instruments that represent capabilities and lessons learned developed over a period of time. Only LASP possesses these capabilities and specialized experience and expertise from the previous TIM and SIM instrument builds.

**6. Description of the efforts made to ensure that offers are solicited from as many potential sources as practicable, including whether a notice was or will be publicized as required by Federal Acquisition Regulation (FAR) 5.202:**

In accordance with FAR subpart 5.2, this procurement was posted on the NASA Acquisition Internet Service (NAIS) on August 4, 2008, in order to inform potential sources of NASA's intent to award this effort to LASP and to provide them with the opportunity to be considered based on their qualifications and capabilities.

**7. A determination by the Contracting Officer that the anticipated cost to the Government will be fair and reasonable:**

By signature of this document, the Contracting Officer determines that the anticipated cost to the Government will be fair and reasonable. LASP will be required to submit a proposal to be evaluated and negotiated by the Government. The proposal will contain sufficient information to determine reasonableness of the price.

**8. Description of the market research conducted and the results, or a statement of the reasons market research was not conducted:**

Market research was conducted and resulted in the determination that no sources other than LASP can build a TSIS system that meets the NPOESS C1 requirements within the mission schedule. Only LASP has the heritage, expertise, and facilities required to build the TSIS.

On an annual basis, science workshops are conducted for the SORCE and Glory missions to bring together scientists and interested parties from domestic and international organizations involved in solar irradiance research and associated instrument development activities. Based on annual interactions with over 50 experts in the field of solar irradiance measurements, it has been clearly established over the last 6 years (with the most recent science workshop meeting held in February 2008), that there are no organizations in the world with the heritage, expertise, facilities, and demonstrated capability to build and test a space qualified TSIS on a schedule or for a cost consistent with LASP's capability. In addition, GSFC released a synopsis that described the TSIS effort on August 4, 2008, and requested interested parties to respond to the contracting officer on or before August 18, 2008. No responses were received from industry.

**9. Other facts supporting the use of other than full and open competition:**

The TSIS instrument software developed and qualified at LASP for instrument operation is unique to LASP. This software has been tested and qualified by NASA for flight programs. It drives the onboard algorithms used in the phase-sensitive detection that is unique to TIM and SIM. This software runs on the Digital Signal Processors located in the TIM and SIM detector head assemblies and has proven fully successful on orbit for SORCE and in ground testing on Glory. Additionally, software in the microprocessor unit designed for the power PC architecture was developed at LASP and will be used on TSIS. This software drives the command and telemetry processes of the TSIS detectors and synchronizes it with the 1553 interface protocol. Ninety percent reuse of existing code is expected on the TSIS mission. Software continues to be a cost and schedule driver for NASA missions and the re-use of flight software is an important element in reducing project risk. The development of a new TSIS system would cause unacceptable delays to the NPOESS C1 mission and would incur significantly higher costs than will this procurement.

**10. Sources, if any, that expressed an interest, in writing, in the acquisition:**

To date, no sources expressed an interest in writing to the notice published in the NAIS of our intent to issue this contract to LASP.

**11. The actions the Agency may take to remove or overcome any barriers to competition before any subsequent acquisition for the supplies or services required:**

It is not expected that GSFC can overcome the barriers of competing this TSIS instrument procurement. Noncompetitive acquisition of this TSIS instrument is an isolated case resulting from the circumstances described above. There is no follow-on effort planned because this procurement will take the mission to the end of its expected life.